claims 1-3, 5-8, 10-15, and 17-20 of co-pending Application No. 09/100,605 (hereinafter the '605 application). The Examiner notes that although the conflicting claims are not identical, they are not patentably distinct from each other because the alloy compositions in the instant claims are overlapped by the alloy compositions of the co-pending application. Applicants wish to point out that the '605 application has been allowed and issued as U.S. Patent No. 6,258,317 on July 10, 2001. Upon allowance of the presently pending claims, Applicants are willing to submit a Terminal Disclaimer in the present case to obviate the rejection of obviousness-type double patenting, if required. allowed

Claims 1, 4-7, 10-13 and 16-19 stand rejected under 35 U.S.C. §102(b) as anticipated by or, in the alternative, under 35 U.S.C. §103 as being unpatentable over the previously applied Shankar et al., Sileo et al., or Grant references.

All of the pending claims have been amended herein to eliminate the modifier "about" with respect to the claimed constituent ranges.

The present invention is directed to a nickel base alloy which provides high temperature and high strength applications involving corrosion-inducing environments over a complete spectrum of carburizing, oxidizing, nitriding and sulfidizing atmospheres. When optimum levels of chromium, aluminum and critical microalloying levels of yttrium and zirconium are present in the alloy, outstanding corrosion resistance will be achieved in this complete spectrum of corrosion-inducing environments. That feature is now present in new claim 20.

As pointed out on page 3 of the instant specification, at lines 27-32, however, where only carburizing and oxidizing corrosion resistance is required, the microalloying with zirconium can be omitted from the composition. When only sulfidizing and oxidizing corrosion resistance is required, yttrium can be omitted from the composition.

An addition of 21.5-28 wt.% chromium as required in claim 1 imparts oxidation resistance to the alloy. Chromium levels less than 21.5 wt.% are inadequate for oxidation resistance, while levels above 28 wt.% chromium can produce detrimental chromium-containing precipitates. The specification further points out that an addition of 4.5-9.5 wt.% molybdenum contributes to stress corrosion cracking resistance and contributes solid solution strengthening to the matrix of the material. Aluminum in an amount ranging from 2-3.5 wt.% contributes to oxidation resistance and precipitates as γ' phase to strengthen the matrix at intermediate temperatures.

It is critical in the present invention for sulfidization resistance that the alloy contain a minimum of 0.01 wt.% zirconium to stabilize the scale against inward migration of sulfur through its protective layer. Zirconium additions above 0.6 wt.% adversely impact the alloy's fabricability. Advantageously, an addition of at least 0.005 wt.% yttrium improves both oxidation and nitridation resistance of the alloy and is critical to establish carburization resistance. The present specification further points out that yttrium levels above 0.1 wt.% increase the cost and decrease the hot workability of the alloy. When the claimed optimum levels of chromium, aluminum and critical microalloying levels of yttrium and zirconium are present, the balanced outstanding corrosion resistance will be achieved and corrosion resistance in the complete spectrum of carburizing, oxidizing, nitriding and sulfidizing environments is achieved. Clearly, no such combination of properties or critical ranges are taught or suggested in any of the cited prior art.

For example, Shankar et al. discloses in column 3, lines 7-50, and at column 4, lines 8-24, cited by the Examiner, extremely broad ranges of 4-40% chromium, for example, as well as up to 10% aluminum, up to 5% yttrium and up to 1% zirconium, up to 30%

molybdenum, all as optional additions. The Examiner has ignored the preferred compositional ranges taught by Shankar at column 3, line 51 bridging to column 4, line 7, which provides 5-10 wt.% cobalt, 8-16 wt.% chromium, 3-7 wt.% aluminum, 1-3 wt.% titanium, and up to 5 wt.% yttrium. This is contrasted with Applicants' claimed cobalt range in claim 1, for example, of 12-18 wt.% cobalt, 21.5-28 wt.% chromium, 2-3.5 wt.% aluminum and 0.005-0.1 wt.% of yttrium and/or 0.01-0.6 of zirconium. Likewise, Applicants teach that carbon levels should be restricted to no more than 0.15 wt.% and point out on page 4 of the present specification, at lines 14-15, that carbon levels above 0.15 wt.% can precipitate detrimental carbides. Shankar, on the other hand, permits carbon additions up to 3 wt.%. Shankar's failure to teach or suggest the criticality of the zirconium, yttrium, titanium, molybdenum, cobalt and chromium ranges in achieving optimum corrosion resistance in carburizing, oxidizing, nitriding and sulfidizing environments fails to negate the patentability of the instantly claimed invention.

This is, likewise, true of Sileo which fails to teach or suggest the critical combination of alloy constituents set forth in Applicants' pending claims to obtain the optimum corrosion resistant properties in the recited environments. The Examiner has completely ignored the relevant, specific teaching of Sileo of the alloy compositions set forth in Table 1 appearing in column 7 thereof. None of the alloys 1, 2 or 3 discloses or suggests the critical molybdenum content of the present invention. This cannot create an anticipation, nor does it establish *prima facie* obviousness since there is no overlap. Sileo teaches <u>0-4.0 molybdenum</u> while Applicants, in claim 1, for example, require a molybdenum content of 4.5-9.5 wt.%, claim 7 requires 4.5-9 wt.% Mo, and claim 13 requires 5-8.5 Mo. Hence, neither anticipation nor *prima facie* obviousness is present.

The same is true with respect to the Grant reference. Grant fails to anticipate or render obvious Applicants' claimed invention with respect to the failure to overlap the claimed chromium ranges, nor does Grant teach any addition of yttrium and/or zirconium, which are critical in the present invention as pointed out above. Criticality of Y and Zr has been established in the present application. See, for example, Table 9 appearing on page 11 of the instant application which compares alloys of the present invention containing Zr with alloy A which contains no Zr, as in the Grant reference. The data show that alloys containing a minimum Zr content of about 0.01 wt.% are unexpectedly, extremely resistant to sulfidation compared to alloy A. Table 10 shows comparable results with respect to nitridation resistance.

In addition, Yakuwa does not render obvious or anticipate the presently pending claims due to its disclosure of a chromium range of 18-21 wt.%, which does not overlap any of the instant claims. In addition, Yakuwa fails to disclose the addition of the critical yttrium constituent. Yakuwa was applied against claims 1 and 4-6 under 35 U.S.C. §102(b) as anticipated or, in the alternative, under 35 U.S.C. §103.

In applying the Grant reference in paragraph 10 of the Office Action, the Examiner stated: "Grant teaches about 28-45 wt.% Cr which is about the same as claimed Cr contents (instant claims 4, 7 and 10 about 27 wt.% Cr; claim 19 about 26 wt.% Cr)....Moreover, it is well settled that a *prima facie* case of obviousness would exist where the claimed ranges and prior art do not overlap but are close enough that one skilled in the art would have expected them to have the same properties," the Examiner citing *In re Titanium Metals Corporation of America v. Banner*, 227 USPQ 773 (Fed.Cir. 1985), and others. It should be pointed out to the Examiner that the modifier "about" has been deleted from the claims in issue. Hence, the word "about" should not be used in an attempt to enlarge the upper limit of Applicants' chromium contents. It is further submitted that 28% does not

overlap and cannot be considered "close enough to" 27% or 26 wt.% in the same context as the *Titanium Metals Corporation* case. That case is misapplied by the Examiner. The prior art in the *Titanium Metals* case disclosed a titanium base alloy containing 0.25 % by weight Mo and 0.75% nickel which fell squarely within the ranges of 0.2-0.4% Mo and 0.6-0.9% Ni of claims 1 and 2 in the application on appeal. Claim 3, at issue in the reported case, had a composition of 0.3% Mo and 0.8% Ni, balance titanium. Two of the titanium base alloys in the prior art contained 0.25% Mo-0.75% Ni and 0.31% Mo-0.94% Ni, respectively. The statement made by the Examiner, "The proportions are so close that *prima facie* one skilled in the art would have expected them to have the same properties" was made with reference to these comparisons, wherein the alloys of the prior art contained <u>all of the constituents of the claimed alloy</u> and wherein <u>the differences were 0.05%</u> from one another and not the large differences found in the present case. In addition, the prior art reference in the *Titanium Metals* case disclosed examples which <u>anticipated the ranges</u> set forth in claims 1 and 2 of the application. The present case is distinguishable over *Titanium Metals* since the cited prior art does not duplicate all of the claimed constituents, nor are the ranges disclosed in the prior art as close as those present in *Titanium Metals*. Hence, it is improper to assume in the present case that the cited prior art would possess the same properties as the claimed alloys. Indeed, Applicants' test results reported in Tables 3 to 10 amply demonstrate the criticality of the various constituents such as Al, Zr, Ti and Y. More specifically, see Tables 6 and 7 for the comparative oxidation resistance data which show the significant contribution of aluminum. The enhanced oxidation resistance is progressively increased at 1200°C with increasing aluminum content and further enhanced by the microalloying addition of yttrium in alloy 8. Scale integrity at 1100°C was enhanced as shown by the positive mass changes by yttrium, zirconium and nitrogen and maintained at 1200°C as seen in Table 7. Resistance to carburization is shown in Table 8 versus alloy A which contained no microalloying additions

of Zr, Y and/or N. The application, as filed, clearly demonstrates unexpected properties obtained over these critical narrow ranges.

In light of the amendments made hereinabove, taken with the above comments, the Examiner's reconsideration and favorable action with respect to claims 1, 4-7, 10-13 and 16-20 are respectfully requested.

Respectfully submitted,

WEBB ZIESENHEIM LOGSDON
ORKIN & HANSON, P.C.

By Kent E. Baldauf

Kent E. Baldauf
Registration No. 25,826
Attorney for Applicants
700 Koppers Building
436 Seventh Avenue
Pittsburgh, PA 15219-1818
Telephone: 412-471-8815
Facsimile: 412-471-4094

Serial No. 09/148,749
Attorney Docket PC-3201
Our File 3237-990857

MARKED-UP VERSION OF CHANGES MADE

IN THE CLAIMS:

Claims 1, 4-7, 10-13, and 16-19 have been amended as follows:

1. (Three Times Amended) A nickel-base alloy resistant to carburizing, oxidizing, nitriding and/or sulfidizing environments, consisting of, in weight percent, [about] 42 to 58 nickel, 21.5 to 28 chromium, [about] 12 to 18 cobalt, [about] 4.5 to 9.5 molybdenum, [about] 2 to 3.5 aluminum, [about] 0.05 to 2 titanium, at least one microalloying agent selected from the group consisting of about 0.005 to 0.1 yttrium and about 0.01 to 0.6 zirconium, [about] 0.01 to 0.15 carbon, [about] 0 to 0.01 boron, [about] 0 to 4 iron, [about] 0 to 0.4 manganese, [about] 0 to 1 silicon, [about] 0 to 1 hafnium, [about] 0 to 0.4 niobium, [about] 0 to 0.1 nitrogen, incidental impurities and deoxidizers.

4. (Twice Amended) The alloy of claim 1 including [about] 43 to 57 nickel, [about] 21.5 to 27 chromium and [about] 12.5 to 17.5 cobalt.

5. (Once Amended) The alloy of claim 1 including [about] 2.25 to 3.5 aluminum and [about] 0.06 to 1.6 titanium.

6. (Once Amended) The alloy of claim 1 including [about] 0.01 to 0.5 zirconium, [about] 0.01 to 0.14 carbon and [about] 0.0001 to 0.01 boron.

7. (Twice Amended) A nickel-base alloy resistant to carburizing, oxidizing, nitriding and/or sulfidizing environments, consisting of, in weight percent, [about] 43 to 57 nickel, 21.5 to 27 chromium, [about] 12.5 to 17.5 cobalt, [about] 4.5 to 9

molybdenum, [about] 2.25 to 3.5 aluminum, [about] 0.06 to 1.6 titanium, at least one microalloying agent selected from the group consisting of [about] 0.01 to 0.08 yttrium and [about] 0.01 to 0.5 zirconium, [about] 0.01 to 0.14 carbon, [about] 0.0001 to 0.01 boron, [about] 0 to 3 iron, [about] 0 to 0.4 manganese, [about] 0.01 to 1 silicon, [about] 0.01 to 0.8 hafnium, [about] 0.00001 to 0.08 nitrogen, incidental impurities and deoxidizers.

10. (Once Amended) The alloy of claim 7 including [about] 44 to 56 nickel, [about] 22 to 27 chromium, [about] 13 to 17 cobalt and [about] 5 to 8.5 molybdenum.

11. (Once Amended) The alloy of claim 7 including [about] 2.5 to 3.5 aluminum and [about] 0.08 to 1.2 titanium.

12. (Once Amended) The alloy of claim 7 including [about] 0.02 to 0.5 zirconium, [about] 0.01 to 0.12 carbon and 0.01 to 0.009 boron.

13. (Twice Amended) A nickel-base alloy resistant to carburizing, oxidizing, nitriding and/or sulfidizing environment, consisting of, in weight percent, [about] 44 to 50 nickel, 22 to 27 chromium, [about] 13 to 17 cobalt, [about] 5 to 8.5 molybdenum, [about] 2.5 to 3.5 aluminum, [about] 0.08 to 1.2 titanium, [about] 0.01 to 0.07 yttrium, [about] 0.02 to 0.5 zirconium, [about] 0.01 to 0.12 carbon, [about] 0.001 to 0.009 boron, [about] 0.1 to 2.5 iron, [about] 0 to 0.4 manganese, [about] 0.02 to 0.5 silicon, [about] 0 to 0.7 hafnium, [about] 0.0001 to 0.05 nitrogen, incidental impurities and deoxidizers.

16. (Once Amended) The alloy of claim 13 including [about] 45 to 55 nickel, [about] 22 to 26 chromium, [about] 14 to 16 cobalt and 5 to 8 molybdenum.

17. (Once Amended) The alloy of claim 13 including [about] 2.75 to 3.5 aluminum and [about] 0.1 to 1 titanium.

18. (Once Amended) The alloy of claim 13 including [about] 0.01 to 0.06 yttrium, [about] 0.02 to 0.4 zirconium, [about] 0.02 to 0.1 carbon and [about] 0.003 to 0.008 boron.

19. (Once Amended) The nickel base alloy of claim 13 containing [about] 2.75 to 3.5 aluminum, [about] 0.003 to 0.008 boron, [about] 0.02 to 0.1 carbon, [about] 14 to 16 cobalt, [about] 22 to 26 chromium, [about] 0.5 to 2 iron, [about] 0 to 0.5 hafnium, [about] 5 to 8 molybdenum, [about] 0.01 to 0.05 nitrogen, [about] 0 to 0.2 niobium, [about] 45 to 55 nickel, [about] 005 to 0.4 silicon, [about] 0.1 to 1 titanium, [about] 001 to 0.06 yttrium and [about] 0.02 to 0.4 zirconium.

New claim 20 has been added:

20. A nickel-base alloy resistant to carburizing, oxidizing, nitriding and sulfidizing environments consisting of, in weight percent, 42 to 58 nickel, 21.5 to 28 chromium, 12 to 18 cobalt, 4.5 to 9.5 molybdenum, 2 to 3.5 aluminum, 0.05 to 2 titanium, 0.005 to 0.1 yttrium, 0.01 to 0.6 zirconium, 0.01 to 0.15 carbon, 0 to 0.01 boron, 0 to 4 iron, 0 to 1 manganese, 0 to 1 silicon, 0 to 1 hafnium, 0 to 0.4 niobium, 0 to 0.1 nitrogen, incidental impurities and deoxidizers.